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ABSTRACT

Operations tasking for data center management is discussed. The original and revised organizational structures of the data center at the University of Miami are also described. The organizational strategy addresses the functions that should be performed by the data center, anticipates the specialized skills required, and addresses personnel retention and pathing. Data center operations must be organized and managed as an autonomous unit within the information systems structure. Data center operations must provide an environment composed of four major sub-areas: task execution, production, hardware services, and software services and management. Task execution pertains to the operation of hardware in the support of executing systems, while production is associated with workload definition, scheduling, job management, and input/output control. Operations tasking provides data center operations management with a quantified understanding of system capacity as well as the present and future workloads. This, in turn, will permit the development of plans and schedules to meet current and emerging requirements. Further, it will permit the monitoring of system and user performance to ensure correctness of execution and adequacy of planning. (SW)

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DATA CENTER TASKING

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Managing the information systems function has always been a dynamic, demanding challenge even in the tightly controlled, batch processing environment. Today with the advent of data base management systems, high level languages and most importantly, a rapidly growing population of knowledgeable users, the challenge is even greater. Integration demands an open, progressive approach to data center management that maintains the fine balance between being driven and driving. This paper is a discussion of data center tasking and presents a few ideas about organizing to accomplish those tasks.

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I. INTRODUCTION

In the past, managing a data center involved providing processing capability for systems developed by an in-house applications programming group. Systems were invariably batch oriented and, although the processing steps required to execute an individual system might have been many and complex, the number of actions making demands on the computer system was usually limited to a few at any given time. Since all development was accomplished under the direction of the data center director, delimiters could and were placed on the demands to be made by an application system up on hardware resources. Further, since application systems development occurred on site, new system performance characteristics were usually determinable prior to actual system implementation. Finally, with on site development, programmer expertise was readily available when problems occurred. In fact, the data center operations staff derived its workload from in-house and, as such, was almost totally dependent on that source for guidance/support. Such is no longer the case.

With the advent of concepts such as packaged application systems, networking, end user computing and high level languages, the demands placed upon the data center by external entities have increased such that their impact will soon, if they have not already done so, greatly exceed the capabilities of the internal applications programming group. In addition, this impact can no longer be controlled as it was in the past, nor is it possible to get the "feel of a system" prior to implementation. This is especially true for servicing end user computing where workload requirements can be generated on an ad hoc basis. In this environment, the internal applications programming group has become but one of many users serviced by the data center operations group. Because of this, the data center is taking on characteristics of other than a commercial automated data processing services center.

While operations represents the prime area affected by the changing environment, it is but one aspect of the information systems organization (Data Center). Its inter-and intra-relationships cannot be intelligently discussed without directing attention to organizational strategy. Thus, before specifically discussing operations' tasking an understanding of data center organizational strategy is necessary.

II. ORGANIZATIONAL STRATEGY

The overall objective of an organizational strategy is to anticipate changes required within the data center organization in order to provide for the successful implementation of the University's mission. The strategy addresses the functions which should be performed by the data center, anticipates the specialized skills required, and addresses skills development, personnel retention factors and career pathing.

A. TARGET ORGANIZATION STRUCTURE

1. Original Organization

The original organization is depicted in Figure 1. The overall structure was divided into two major units, Academic/Research Systems and Administrative Systems. The Academic/Research unit was charged with supporting and advising the faculty and student user base, while all other functions were assigned to

ORIGINAL ORGANIZATIONAL CHART

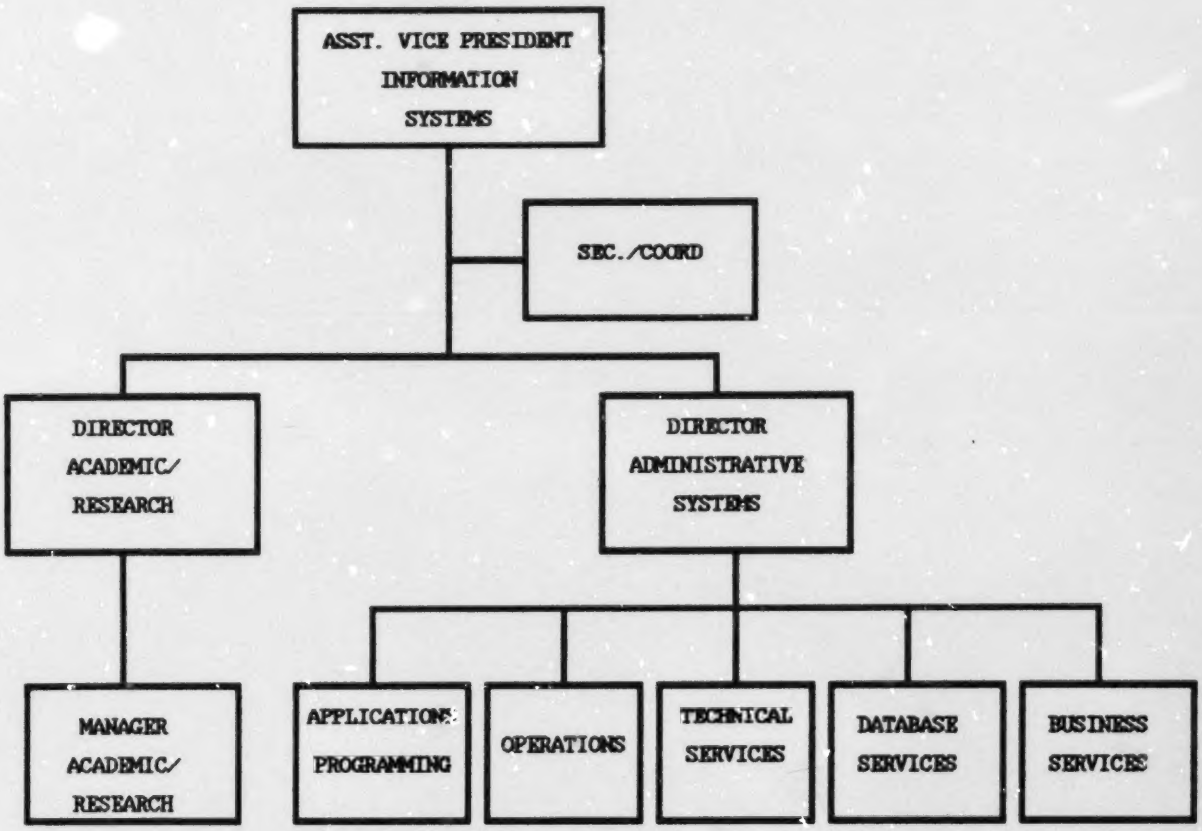

FIGURE 1

the Administrative Systems unit. The departments which constituted Administrative Systems were as follows:

- Computer Operations
- Technical Services
- Data Base Services
- Systems & Programming
- Business Office

While, the Systems and Programming and Data Base Departments were oriented towards the administrative user group, the other groups served concurrently, both the academic and administrative communities. This created the appearance of a conflict of interest with respect to resource allocation.

Within the Systems and Programming department, the professional staff was divided between new system development projects and ongoing application system maintenance support. These dissimilar functions occasionally created competition for programming resources that sometimes caused serious delays in new project implementation.

Additionally, the original organization inadequately addressed the following functions:

- Security Administration
- Planning and Capacity Monitoring
- Quality Assurance
- Unit-wide Change Control & Problem Management
- Professional Development (training, career planning)
- Resource Management
- Office Automation Support
- Administrative End-user Computing Support

2. Revised Organization Structure

The revised organization is depicted in Figure 2. This structure attempts to rectify the problems outlined above by specifically providing for the functions inadequately addressed, and by recognizing that, inherently, data processing activities fall into the following categories of tasks which are:

- Project Oriented (long duration)
- Critical on a daily basis (including emergencies)
- Critical but not on a daily basis (including planning)

The new organization recognizes the significance of the resources to be committed to implementation of the University's plans and has isolated those project-oriented functions from the management of critical and non-critical daily functions. The classical data center functions, such as operations and technical support, are combined and managed by a director; the Academic and Research group remains unchanged and those functions which are critical but not on a daily basis are managed by another director. Additionally, the high investment and exposure of the implementation of new administrative application development calls for the full-time attention of a director.

The University of Miami is committed to the concurrent management of six new application development projects, an ambitious undertaking. Naturally, during this period of concentrated new development, existing applications must be maintained and kept functioning. The existing systems are batch-oriented,

REVISED ORGANIZATIONAL CHART

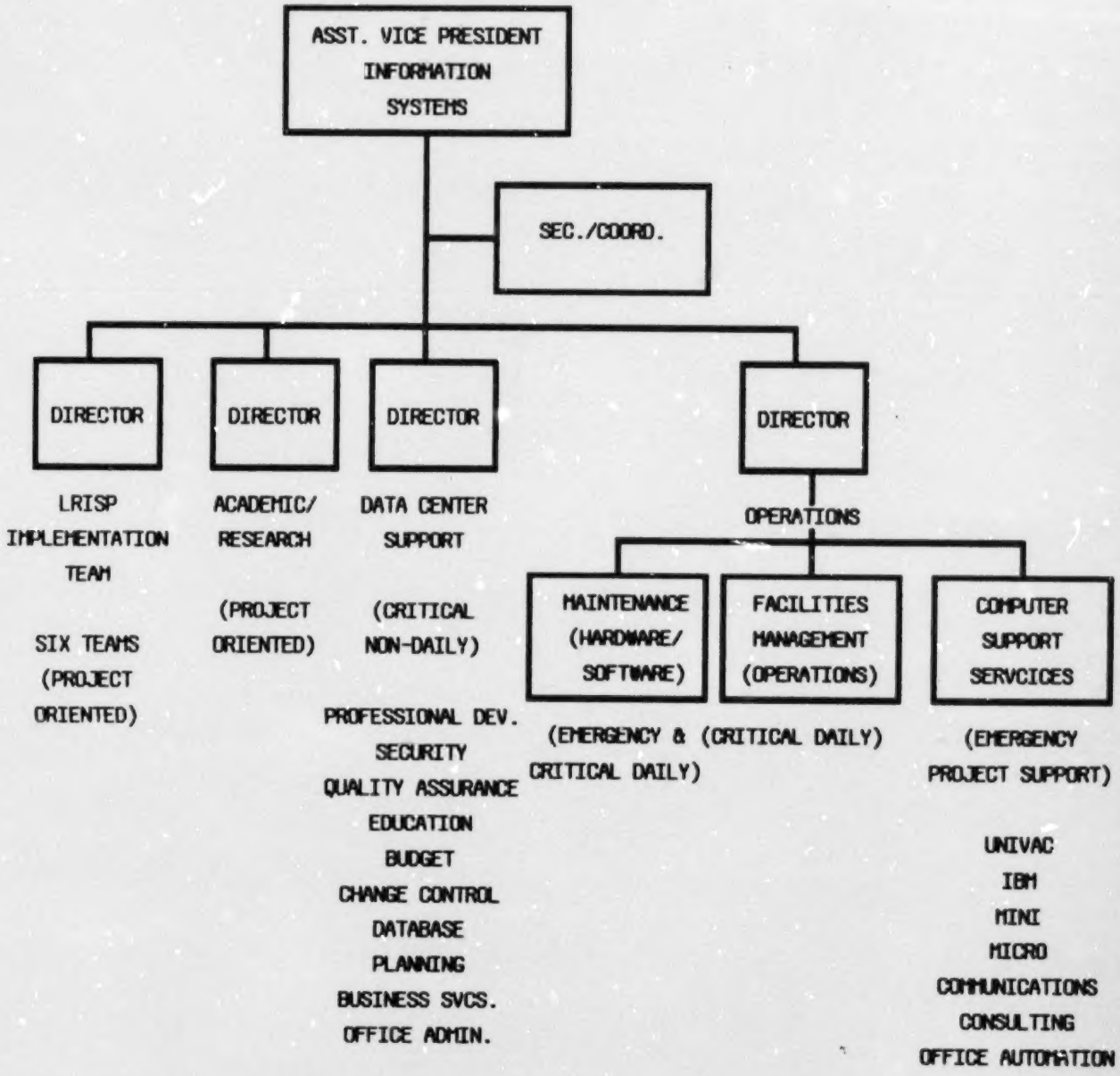

FIGURE 2

poorly documented, incorporate few automated controls, and utilize various inconsistent standards and conventions. Consequently, the operation and maintenance of these systems is very labor intensive. Batch technology requires scheduling, set-up, and verification of successful completion. Because data are passed from one application to another, additional batch interface jobs must be managed and manually controlled.

With the advent of on-line and data base technologies as well as an integrated approach, new application systems may now be designed and developed so as to minimize operation and maintenance costs. However, until the bulk of applications are implemented under this more cost-effective technology, the operation and maintenance of existing systems will remain labor intensive. The University has two incompatible main frames and temporary interfaces must be implemented to handle data passed between new applications on the IBM mainframe and old applications on the UNIVAC mainframe. This will place an even heavier demand upon data center's operations staff.

An increase in the number of personnel necessary to support the new development effort as well as operation and maintenance of existing labor-intensive systems is expected to be required for the next several years. After this period, personnel may be reassigned to perform functions resulting in increased levels of service. Thus, data center tasking has changed especially for the operations unit. A more detailed discussion of this change follows.

B. DATA CENTER-OPERATIONS

Data center operations must be organized and managed as an autonomous unit within the information systems structure. It must be capable of accomplishing all the tasks necessary to provide processing services regardless of the source. Specifically data center operations must provide an environment composed of four major subareas outlined in Figure (3).

1. Task Execution

Task execution involves those tasks normally associated with equipment operation and generally consists of providing equipment operators, managing the tape library, communications network monitoring and contacting vendor representatives in the case of equipment malfunction. The staff that accomplishes these tasks are usually shift workers and are event driven. As such, assigning projects beyond that which can be accomplished in a single shift should be avoided. This is not to say that their input into such projects should not be solicited and valued. Further, because the nature of the work requires immediate response to system messages, actions that divert the operator's attention for other than a very brief period of time should, by matter of policy, be referred to another group. This function is almost entirely internally oriented and communication with external units should be severely limited.

In brief, the area of task execution provides those capabilities associated with the operation of hardware in the support of executing systems. It is not a planning agency - it is a doing agency.

DATA CENTER TASKING

Operations Unit

Task Execution	Production
- Primary Console Staffing - Communications Network Monitoring - Tape Management - Peripheral Support Operations	- Service Level Agreements - Workload Definition - Scheduling - Daily Capacity Optimization - Input/Output Control - Production Library Maintenance - Job Execution - Production Problem Determination and Restart
(Providing the Operating Environment)	(Providing the Run Execution Environment)
Hardware Services	**Software Services and Management**
- Equipment Selection - Contract Administration - Operator Training - Communication Network Management - Facilities Security	- Maintenance Programming for current applications - Operating System - Database - Data Communication Support - General Package Support - Software Security - Secondary Storage Management - Internal Standards Coordination - System Monitoring and Tuning - Internal Management Systems - Consulting with users - Office Automation Facilitating, Coordinating and Advising
(Providing the hardware environment)	(Providing the software and consultation environment)

Figure 3

2. Production

Production involves those tasks normally associated with workload definition, scheduling, job management and input/output control. This unit is the primary point of contact for matters dealing with processing systems and is the management group for all "production systems" - that is those systems for which the data center has accepted the responsibility for scheduling, setup, and execution. Unlike task execution, production goes beyond merely executing systems. Rather, tasking here is on two levels - providing for runs/systems in the aggregate, and providing for individual run execution. This area is responsible for production systems from implementation through cancellation.

In summary, this area is the key to ensuring a successful production effort. The greater their success in executing endeavors, the fewer are the requirements for restart/recovery and massive periodic validation of documentation, programs, schedules, etc.. If well organized and controlled, the production environment can be an extremely stable, predictable environment of known dimensions.

3. Hardware Management

Hardware management involves those tasks normally associated with providing facilities, administering hardware contracts, managing equipment inventories, enforcing security and providing in-house operator training. As such, this activity is the primary point of contact for all matters dealing with the selection, placement, operation and maintenance of equipment. It is also responsible for operator training - including that associated with the physical communications network. Like the production area, this area provides a tactical planning capability as well as task execution. However, unlike the production area, this area is not primarily concerned with the processing environment, rather its interest spans all activities associated with data center operations.

In summary, the Hardware management group is concerned with a wide range of tasks by providing the hardware and a suitable environment for its operation. It is the manager of the information system's physical environment.

4. Software Management

Software Management involves activities in support of general use software, internal management systems, systems performance, secondary storage management, database-datacommunications, security, technical documentation and standards and user services. It also includes the facilitating, coordinating and advising for office automation. When used within this section, the term software included not only general purpose software such as operating systems, utilities, programming languages, database-datacommunications handlers, and internal data center applications (such as schedulers, system log reduction programs, help desk tracking systems, and the like); but, it also includes the day to day maintenance of current application systems.

The organizational structure has provided separately, outside of these areas, the nucleus of the data center planning group. There reside the data center change agents and there, also, reside the future character of the data center. However, had that not been done, these functions would occur here.

Software management must be future oriented, and if it becomes bogged down with reacting to daily problems, the center will lose its forward momentum. Thus, organizationally we have segmented out all non-emergency and daily critical functions such as planning, quality assurance, professional development and new application programming.

Systems software should be managed along the same lines as hardware. One does not even consider building his own hardware, and when procuring it, one ensures that specifications and a maintenance contract are available. In the same light, one should not procure a systems software package with the intent to modify it and provide maintenance internally. Operating systems, database-datacommunications systems, end user support packages, are just too numerous, too large and too complex for such a mode of operation. This also applies to purchased applications software packages, maintenance should be provided by the vendor, for as external requirements change (IRS, state regulations) so must the package.

III. SUMMARY

In summary, operations tasking should be as outlined in Figure (3). This tasking will provide data center operations management with a quanitifed understanding of system capacity as well as the present and future workloads. This will, in turn, permit the development of plans and schedules to meet current and emerging requirements. Further, it will permit the monitoring of system and user performance to ensure correctness of execution and adequacy of planning. Thus, the variance between that which was planned and actual occurrence can be closely monitored permitting early detection of adverse trends and timely development of effective countermeasures.

The knee jerking spasms that inevitable occur when the reactionary mode of management exists can be avoided by following the organization strategy delineated above. Data center management may then be proactive and take on the characteristics of a dynamic, aggressive, future oriented organization capable of addressing wide ranging requirements. This is mandatory if information systems is to appropriately address the challenges of today and tomorrow.